

WHAT IS CLAIMED IS:

1 1. A method for the secure handling of information encrypted to
2 a data set, the information requested by a requesting consumer client, the data set
3 stored on at least one storage device, the method comprising decrypting a value
4 required to decrypt the information, the value decrypted by correctly solving an
5 access formula describing a function of groups, each group comprising a list of at
6 least one client, wherein the requesting consumer client is granted access to the
7 information if the requesting consumer client is a member of at least one group
8 which correctly solves the access formula.

1 2. A method for the secure handling of information as in claim
2 1 wherein the encrypted value and the access formula are stored as metadata in the
3 data set.

1 3. A method for the secure handling of information by at least
2 one client using at least one untrusted storage device, each client connected to the at
3 least one untrusted storage device using a network, the network further having a key
4 manager for issuing private key and public key matched pairs for use with an
5 asymmetric encryption and decryption scheme, the scheme allowing a file encrypted
6 with a public key to be decrypted only with a matched private key, the method
7 comprising:
8 creating at least one group, each group comprising a list of at least one
9 consumer client;
10 acquiring a public key and a matched private key for each of the at
11 least one group;
12 encrypting an information set to produce a data set, the encryption
13 based on a randomly generated number;
14 determining an access formula expressing logical combination of the
15 at least one group for which access to the information set will be granted, solution
16 of the access formula by at least one solution group indicating that a consumer client
17 belonging to the at least one solution group may access the encrypted information
18 set;

19 asymmetrically encrypting the randomly generated number using the
 20 determined access formula and the public key for each of the at least one group
 21 granted access to the information set;
 22 adding the encrypted randomly generated number to the data set; and
 23 storing the data set on at least one untrusted storage device.

1 4. A method for the secure handling of information as in claim
 2 3 wherein a consumer client having a public key and a matched private key requests
 3 access to information encrypted in the stored data set, the method further
 4 comprising:
 5 receiving a request from the consumer client;
 6 determining if the consumer client belongs to at least one solution
 7 group which solves the access formula and, if not, denying access;
 8 otherwise, decrypting the randomly generated number using the
 9 private key for the at least one determined solution group; and
 10 encrypting the randomly generated number using the public key for
 11 the consumer client thereby permitting access to the encrypted information set by the
 12 consumer client.

1 5. A method for the secure handling of information as in claim
 2 4 further comprising recording all attempts to access the information set in an audit
 3 trail, the audit trail including an indication of the consumer client requesting access.

1 6. A method for the secure handling of information as in claim
 2 3 wherein a plurality of groups form a solution to the access formula, asymmetrically
 3 encrypting the randomly generated number creating an encrypted partial key for each
 4 group in the plurality of groups, each partial key encrypted using the public key for
 5 one group in the plurality of groups, each partial key required to decrypt the
 6 encrypted randomly generated number, the method further comprising:
 7 for each group in the plurality of groups, decrypting the encrypted
 8 partial key using the private key for the group;
 9 for each group in the plurality of groups, reencrypting the decrypted
 10 partial key using the public key for a requesting client;

11 decrypting each reencrypted partial key using the private key of the
 12 requesting client;
 13 determining the randomly generated number based on each partial
 14 key; and
 15 decrypting the information set using the determined randomly
 16 generated number.

1 7. A method for the secure handling of information as in claim
 2 3 wherein the access formula is a boolean combination of groups, a group asserting
 3 true in the boolean combination when a consumer client member of the group
 4 requests access to the information set protected by the access formula, the consumer
 5 client group member granted access if the access formula resultant is true.

1 8. A method for the secure handling of information as in claim
 2 3 further comprising:
 3 determining that an information set destined for storage on at least one
 4 untrusted storage device is encrypted; and
 5 prohibiting storage on the at least one untrusted storage device if the
 6 information set is determined not to be encrypted.

1 9. A system for the secure handling of information stored on at
 2 least one untrusted storage device connected to a network comprising:
 3 a key manager connected to the network, the key manager operable
 4 to generate private key and public key matched pairs for use with an asymmetric
 5 encryption and decryption scheme, the scheme allowing a file encrypted with a
 6 public key to be decrypted only with a matched private key;
 7 at least one group server connected to the network, each group server
 8 operable to
 9 (a) maintain at least one group, each group comprising a
 10 list of client members allowed access to information
 11 produced by any client member of the group, and
 12 (b) obtain a private key and matched public key for each
 13 group; and

14 at least one producer client connected to the network, the producer
15 client operative to

- 16 (a) encrypt an information set to produce a data set, the
17 encryption based on an encryption value,
18 (b) determine an access formula expressing logical
19 combination of the at least one group for which access
20 to the information set will be granted, solution of the
21 access formula by at least one solution group
22 indicating that a client belonging to the at least one
23 solution group may access the encrypted information
24 set,
25 (c) asymmetrically encrypt the encryption value using the
26 determined access formula and the public key for each
27 of the at least one group for which access to the
28 information set may be granted,
29 (d) add the encrypted encryption value and the access
30 formula to the data set, and
31 (e) store the data set on at least one untrusted storage
32 device.

1 10. A system for the secure handling of information as in claim 9
2 wherein the encryption value comprises a randomly generated number.

1 11. A system for the secure handling of information as in claim 9
2 wherein the access formula is a boolean combination of groups, a group asserting
3 true in the boolean combination when a client member of the group requests access
4 to the information set protected by the access formula, the client member granted
5 access if the access formula resultant is true.

1 12. A system for the secure handling of information as in claim 9
2 wherein the producer client is further operable to
3 determine that an information set destined for storage on at least one
4 untrusted storage device is encrypted; and

5 prohibit storage on to the at least one untrusted storage device if the
6 information set is determined not to be encrypted.

1 13. A system for the secure handling of information as in claim 9
2 further comprising at least one consumer client connected to the network, each
3 consumer client operative to
4 obtain a private key and a matched public key;
5 determine that an accessed data set has encrypted information;
6 determine at least one group server maintaining at least one group
7 from the access formula logical combination, the at least one group forming a
8 solution to the access formula;
9 send a request to access the encrypted information set to each of the
10 at least one determined group server;
11 if access is granted from each of the determined at least one group
12 server, decrypt the encryption value using the obtained private key; and
13 decrypt the encrypted information set using the decrypted encryption
14 value.

1 14. A system for the secure handling of information as in claim 13
2 wherein the at least one group is a plurality of groups and wherein the producer
3 client asymmetrically encrypts the encryption value to produce a partial key for each
4 group in each set of groups forming a solution to the access formula, the consumer
5 client further operative to decrypt the encryption value by decrypting each partial key
6 and to determine the encryption value based on each decrypted partial key.

1 15. A system for the secure handling of information as in claim 13
2 wherein each group server is further operable to
3 receive a request from a requesting consumer client;
4 determine if the requesting consumer client belongs to at least one
5 solution group which solves the access formula and, if not, deny access;
6 otherwise, decrypt the encryption value using the private key for the
7 at least one determined solution group; and

8 encrypt the encryption value using the public key for the requesting
9 consumer client thereby permitting access to the encrypted information set by the
10 consumer client.

1 16. A system for the secure handling of information as in claim 13
2 wherein each group server is further operable to record all attempts to access each
3 information set in an audit trail, the audit trail including an indication of the
4 consumer client requesting access.

1 17. A system for the secure handling of information as in claim 13
2 wherein each group server is further operable to permit additions, deletions, and
3 changes to each group list of client members.